Online communities of practice typology revisited

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Abstract

This paper outlines a typology for online communities of practice. The typology is based on findings from observations of three online communities of practice, a content analysis of messages, and a review of the existing literature. The three examples of communities of practice are of electronic discussion lists that cover topics of interest to university webmasters, librarians, and educators. This work expands on a typology that consolidated prior research and focused on online communities of practice within organizational settings (Dubé, Bourhis, and Jacob, 2006) by extending it to be inclusive of open online communities of practice that are not constrained by any organizational context. Characterizing communities of practice in this manner enables various aspects of them to be analyzed, which can illuminate ways to support the implementation of effective online communities of practice for specific purposes.

Keywords: online communities of practice, knowledge sharing, typology, community characteristics, collaboration, knowledge management, organizational learning

1. Introduction

The concept of communities of practice was developed by Lave and Wenger [1]. The term has since been popularized by Brown and Duguid [2], following their analysis of Orr's ethnographic study of Xerox technicians (see [3], [4]). More recently, this term has become established in the corporate world (e.g., [5-9]), and many companies have tried to design communities of practice to improve knowledge sharing within their organizations [10]. Because the term 'communities of practice' means different things to different scholars [11], the following is used in this article:

Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis. [8, p. 4]

Not only is this definition more inclusive than others, but it also addresses both organizational communities of practice and those that are not constrained by any organizational context (herein called open CoPs).

With the advent of the Internet and the prevalence of information and communication technologies (ICTs), interest in extending communities of practice (CoPs) to online environments has developed. Moving CoPs online offers the potential to reduce or eliminate expensive face-to-face meetings and facilitate networking among people who are geographically distributed. As more online CoPs were forming, studies of online CoPs emerged. Further, the number of researchers investigating the way ICTs might support these virtual communities that transcend time and geographical boundaries has increased [12], [13]. Research on online CoPs has been limited mostly to case studies, and many have focused on CoPs that are confined within organizational settings or within

a particular profession (e.g., [14-16]). Dubé, Bourhis, and Jacob [17] developed a typology of online CoPs through literature reviews and empirical research on 18 online CoPs within 14 different organizations. Their typology provides a holistic framework for understanding CoPs. In an earlier study, this typology was also utilized to analyze leadership in online CoPs [18].

The Dubé et al. typology is a first step toward synthesizing the literature and developing a framework to cross-analyze different types of CoPs. However, one of its major limitations is that the typology is based mainly on CoPs that operate within organizational contexts. This is problematic because open CoPs that are not constrained by organizational boundaries are proliferating today. In the past, knowledge sharing primarily occurred in organizational settings. Recently, many organizations have begun to elicit cooperation outside their own organizations, for example, by utilizing outside researchers and even product consumers for new discoveries [19]. Moreover, the Web 2.0 enables consumers to participate with others to add value to the organizational product and co-create content (e.g., [20]). Stated another way, knowledge sharing in these CoPs no longer takes place exclusively within the boundaries of the organizations. It is unclear to what extent Dubé et al.'s [17] typology could be applied to these open online CoPs. Therefore, there is a need to examine and extend it by using empirical data from open online CoPs settings.

The present study attempts to address this lacuna by asking the following research questions: To what extent is the Dubé et al. typology generalizable to open online CoPs? What are the main dimensions that define open online CoPs and distinguish among them? This paper aims to extend and modify Dubé et al.'s [17] typology of online CoPs. The

revised typology can be used to diagnose online CoPs under multiple dimensions, to develop a plan for fostering online CoPs, and to generally deepen the understanding of online CoPs.

2. Research Background: Online Communities of Practice

With the advent of the Web 2.0 that allows users to become content-generators various companies are no longer limiting their idea generation capabilities to members of their own companies. They began to identify the potential utility of people outside of the organizations by soliciting product and research ideas from them [19]. This type of knowledge sharing is pertinent to the idea of open online CoPs that are not constrained by organizational boundaries. The participatory and social nature of Web 2.0 technologies promotes knowledge sharing opportunities [21, 22], as well as the proliferation of online communities and open online CoPs in particular. These open CoPs have been less of a focus of research on online CoPs. A better understanding of these online CoPs that are not constrained within organizational boundaries becomes crucial.

It is informative to examine the cumulative body of knowledge on online CoPs. Although there is a plethora of studies on online CoPs, these studies tend to be mostly descriptive in nature and focus on online CoPs in various professional settings or on different aspects of CoPs. For example, they focus on the application of CoPs for teacher education [15, 23-25], on identity formation [26], and on the potential of online CoPs (e.g., [13], [27]). Research on CoPs typically includes in-depth case studies of specific groups. Examples of these groups include math and science teachers [23], healthcare professionals [28], lawyers [29], and Caterpillar employees [30]. More recently, a few researchers [27, 31, 32] took a critical approach to the study of online CoPs, and several

analyses of multiple CoPs have emerged to move beyond descriptive accounts. For example, Hew & Hara [28] examined factors that motivate or hinder participants from engaging in knowledge sharing in multiple open online CoPs, and Dubé et al., [17] developed a typology of online CoPs within organizational settings. These studies enrich our understanding of online CoPs by synthesizing multiple online CoPs. Because of the interconnectivity and interactivity associated with the Web 2.0, there is a need for analytical, comparative, and commutative knowledge regarding open online CoPs, as well as research that transcends the common single case study approach.

Unlike many of the earlier studies, Dubé et al. [17] contributed a framework that characterizes online CoPs. Their framework is based on a synthesis of previous studies and empirical research of online CoPs. Although this seminal study extends the research of online CoPs beyond the case study tradition and provides a conceptual framework for CoPs, it has a major limitation - it was developed based on online CoPs that are confined within organizational contexts. The typology consists of four dimensions (Table 1): demographics, organizational context, membership characteristics, and technological environment. The first dimension, 'demographics,' refers to generic characteristics of online CoPs, such as how long CoPs have existed, how CoPs were created, and at which developmental stages CoPs are positioned. The second dimension, 'organizational context,' identifies the organizational environments where CoPs develop and operate. Examples include leadership, degree of formalization, and resources that organizations provide to support the CoP. The extent of boundary crossing within an organization as reflected in CoP diversity is another case in point. The third dimension, 'membership characteristics,' portrays various aspects of the membership at large, such as size and the

CoP's diversity, as well as members' ICT literacy and the membership selection process. The last dimension, 'technological environment,' discusses the extent to which CoPs rely on ICTs and the ways in which different ICTs are employed by CoPs.

Table 1
Typology of organizational online communities of practice (cited from Dubé et al. [17])

Demographics	Orientation Life span Age Level of maturity
Organizational context	Creation process Boundary crossing Environment Organizational slack Degree of institutionalized formalism Leadership
Membership characteristics	Size Geographic dispersion Members' selection process Members' enrollment Members' prior community experience Membership stability Members' ICT literacy Cultural diversity Topics' relevance to members
Technological environment	Degree of reliance on ICT ICT availability

In another study, Dubé et al. [33] used 14 out of 22 categories in the above framework to identify the influence of various structuring characteristics on the success or failure of online CoPs at the initial stage. Some of the original categories are more refined in Dubé et al.'s 2005 study than in their framework that was published in 2006. For instance, the 2005 study found that leadership, supportive organizational environments, topic relevance, and institutionalized formalism are all important factors for successful online CoPs in organizational settings.

In summary, Dubé et al.'s [17] framework is useful in various ways. First, it was a synthesis of many previous case studies of online CoPs (e.g., [15]). Second, it could be employed to characterize certain types of online CoPs and distinguish among them. For example, it was used to identify characteristics of knowledge sharing among professionals participating in different types of online CoPs (e.g., [34]). Yet, the framework is limited because it is restricted to online CoPs that are formed and operate within organizational contexts.

3. Method

To examine and extend Dubé et al.'s [17] typology, analyses of discussions posted to three open online CoPs were conducted. In addition, the cumulative body of knowledge on online CoPs were used.

3.1. Research Sites

We selected three e-mail lists as examples of open online CoPs. The first CoP was for webmasters who work in university settings; the second CoP was for librarians who discuss issues related to digital reference practices; and the third CoP was for individuals interested in sharing information and ideas related to the use and the role of educational technology in university and K-12 school district settings.

The first forum examined in this study is a University Webmaster e-mail list (UW-l). UW-l is one of the largest lists pertaining to web design and development for universities and community colleges primarily in the U.S. Its history goes back to 1997. Membership to UW-l is entirely voluntary and is open to anybody in the world. The discussion is moderated but not filtered. UW-l has more than 2,000 members worldwide, although the

majority of the members who submit posts appear to be affiliated with U.S. higher education institutions. The second list is a Digital Reference e-mail list (DR-l). This is the main list for virtual reference librarians within the U.S. It was established in 1997 by a non-profit organization. Currently there are more than 15,000 members throughout the U.S. and the world. The third list is an Educational Technology e-mail list (ET-l). This list is one of the most established and is the largest online forum for educational technologists within the U.S. It was started in 1989, and there are more than 4,500 members throughout the world, representing approximately 50 countries. It has a unique structure in the sense that the leadership is negotiated and rotated among technology teachers, trainers, and scholars who work to facilitate the interactions and exchange of information among members.

We applied four criteria to determine if these online forums possess characteristics of online CoPs [16]. The four criteria are: members share *practice*, develop a sense of being a part of a *community*, undergo *meaningful* learning through experience, and possess a sense of *identity*. Our analysis is based on a content analysis of 50 messages from each CoP, and observations of online interactions among members over one month. The interactions involve a few hundred contributors on each of CoP. Therefore, we examined only active members of the communities through the messages they posted, while peripheral members who were lurkers were not a part of the analysis (see Appendix A for details). As an example of this identification process, the characteristics of ET-1 as an online CoP are further described.

Members in ET-l have a shared *practice* (i.e., implementing technologies in university and K-12 settings), which brings together various professions that range from

university professors to K-12 media specialists to consultants. More experienced ET-l members routinely share their words of wisdom with others, which serves to illustrate "what is possible, expected, and desirable" [35, p. 156]. Second, based on the observations of their postings, the members appear to be comfortable with each other and seem to develop a sense of belonging to the ET-l *community*.

The discussion list itself fosters an environment that enables participants to learn together about practices that are pertinent to their daily lives and interests. In addition, the distributed nature of membership, as well as the archives, allows the new members to make connections with individuals who may have had similar experiences in other organizations or environments. Third, the discussions in ET-l help members explore fundamentally important questions relevant to their profession and provide a *meaningful* learning environment. A content analysis of some of the messages exchanged revealed that members in ET-l primarily engaged in the activities of sharing knowledge (Appendix A). Through knowledge sharing, these members form a community around their practice and build relationships, resulting in a sense of shared *identity*. Some members also use this community to negotiate meaning obtained from their participation in this and other communities. One ET-l member began a discussion on the list by offering his thoughts on the way technologists view the world of technology:

I think that technologists, since we are proponents, loose sight of the whole, in exchange for a narrow even elitist view that technology is the better way.

Being a technologist appears to be a shared identity among the members in ET-l. In a similar way, the other two e-mail lists selected for this study also satisfied the four criteria listed above.

3.2. Data collection and analysis

We used Dubé et al.'s [17] typology along with the existing online CoP literature to guide our analyses. In addition, following Dubé et al.'s [17] method for development of their typology, we conducted a comparative analysis of three open online CoPs. It involved observations of three online CoPs and a comparative content analysis [36] of messages posted to these three e-mail lists.

First, we conducted observations of three open online CoPs by each author subscribing to one of the online discussion forums. This method was used because it helped the authors become familiar with its context, norms, culture, and members. Each author also read selected messages from the other two forums in order to be familiar with all three forums.

Second, a content analysis of posted messages was conducted to identify the values that can be assigned to some categories (specifically for the following categories: relevancy of discussion, boundary crossing, and cultural diversity). A total of 150 e-mail messages were selected; 50 from each of the three online discussion forums. All three CoPs used the same information and communication technology, an e-mail list, to send and receive electronic messages. However, each list has a unique web-based interface for its archive. All the archives are publicly accessible, although UW-l and DR-l require membership to access their archives. We selected 50 online messages from each forum that were sent during October 2005. The month of October was chosen to avoid the beginning or the end of an academic semester as well as holidays. In order to obtain a

representative set of 50 messages from each list, we chose every other message for DR-l and every seventh message for UW-l and ET-l.

Finally, we incorporated supports from the literature in order to strengthen the typology. The literature was drawn from studies of CoPs, knowledge management, virtual teams, and organizational studies. We examined each dimension of Dubé et al.'s [17] typology (demographics, organizational context, membership characteristics, and technological environment) and assessed whether the existing typology would be applicable to open online CoPs in general. Using our observations and the results of the content analysis as a guide, we also examined the three CoPs in light of each existing category. When our forums did not fit an existing category, we modified the category to be inclusive of our three open online CoPs.

4. Findings and Discussions

4.1. CoP Typology

Based on the examination of the three open online CoPs in light of Dubé et al.'s [17] typology, we modified the original typology. The modified framework addresses both open and organizational CoPs in online environments (Table 2). The last column in Table 2 represents the revised typology; each category will be discussed in the following sections along with the range of values that the category could vary on. While most of the categories would be applicable in both settings, some are more relevant to organizations than to open online environments. In particular, the categories that address issues related to organizations are: environment, organizational slack, degree of institutionalized formalism under the context dimension, and membership stability under the membership

characteristics dimension. For these categories, a ‘not applicable’ value was included for open online CoPs without organizational sponsorship.

Table 2
Revised and original typologies of online CoPs

Dimension	**Original typology (Dubé et al. [17]) (confined within an organizational context)**	**Modified typology (also includes open online CoPs)**
Demographics	1. Orientation (operational-strategic) 2. Life span (temporary-permanent) 3. Age (old-young) 4. Level of maturity (potential - transformation)	1. Orientation (operational-strategic) 2. Life span (discrete-continuous) 3. Age (young-established-old) 4. Level of maturity (potential - transformation + stability +disband)
Context*	1. Creation process (spontaneous-intentional) 2. Boundary crossing (low-high) 3. Environment (facilitating-obstructive) 4. Organizational slack (high-low) 5. Degree of institutionalized formalism (unrecognized-institutionalized) 6. Leadership (clearly assigned-continuously negotiated)	1. Creation process (bottom-up-top-down) 2. Boundary crossing (low-high) a. profession b. organization 3. Knowledge sharing culture* (low-high) 4. Organizational sponsorship* (yes-no) 5. Environment 6. Organizational slack (high-low)^ 7. Degree of institutionalized formalism (unrecognized-institutionalized)^ 8. Leadership (clearly assigned-continuously negotiated)

		a. active participants* b. founding members* c. moderator (+rotating)*
Membership characteristics	1. Size (small-large) 2. Geographic dispersion (low-high) 3. Members' selection process (closed-open) 4. Members' enrollment (voluntary-compulsory) 5. Members' prior community experience (extensive-none) 6. Membership stability (stable-fluid) 7. Members' ICT literacy (high-low) 8. Cultural diversity (homogeneous-heterogeneous) 9. Topics' relevance to members (high-low)	1. Size (small-large) 2. Geographic dispersion (low-high) 3. Members' selection process (closed-open) 4. Members' enrollment (voluntary-compulsory) 5. Members' prior community experience (extensive-none) 6. Membership stability (high-low)^ 7. Members' ICT literacy (high-low) 8. Cultural diversity (homogeneous-heterogeneous) a. national* b. organizational* c. professional* 9. Topics' relevance to members (high-low)
Technological environment	1. Degree of reliance on ICT (low-high) 2. ICT availability (high variety-low variety)	1. Degree of reliance on ICT (low-high + solely reliant on ICT) 2. ICT variety (high-low)

Note:
* indicates new or modified dimensions and categories. Ranges of values are included in parenthesis.
^ indicates categories primarily relevant to online CoPs within organizational context.

4.2. Demographics

All the demographics dimensions in Dubé et al.'s [17] typology were applicable to open online CoPs; however, the interpretation of each category was expanded (Table 3).

1. Orientation refers to the purposes of online CoPs. Dubé et al. [17] suggest that CoPs can vary on their orientation, from operational to strategic. Strategic online CoPs address issues pertinent to the organizational mission and its big picture, whereas operational online CoPs discuss mundane practices. Further, because Dubé et al. [17] classify intra-organizational online CoPs, their definition of the CoP orientation refers to the organizations' intentions for the CoPs' activities, as they are set by particular organizations. Earlier studies focused mostly on operational CoPs [10]. Likewise, the three examples that we examined are operational ET-1 and UW-1 emerged through grassroots efforts and, consequently, are not strategic. While the creation process for DR-1 took a more top down approach, the orientation was not set by the organization. Therefore, like ET-1 and UW-1, the DR-1 orientation is operational. In contrast, Swan, Scarbrough, and Robertson [10] presented a case study of a strategic CoP that focuses on the formation of a new community specifically for the development of a new innovation to treat cancer. As the concept of CoPs becomes more prevalent in business organizations, the number of more strategic CoPs is likely to increase.

2. Life span is the approximate length of time at the moment of its creation that the founders intend the online CoP to last. Dubé et al. [17] propose that the life span can vary from temporary to permanent. Because we cannot predict whether online CoPs will exist permanently or not, the original labeling, 'permanent,' was deemed unsuitable. Therefore, we modified their labels. We suggest that the life span of open online CoPs can vary between discrete (e.g., created to solve a specific problem) and continuous (e.g., formed to connect individuals to outside partners), two characterizations that are further described in Bell and Kozlowski [37]. As such, we described its status at the time of

observation, instead of assuming its permanence into the future. All three open online CoPs are continuous.

3. Age refers to how long an online CoP exists. Dubé et al. [17] suggest that the range for this category is between young (less than a year) and old (more than 5 years). However, we propose a more sensitive measure of age based on three (instead of two) stages of development: young, established, and old. An online CoP is 'young' when it is less than a year old; when it is more than 1 year old but less than 10 years old, it is 'established'; and when an online CoP is more than 10 years old, it is 'old.' All three open online CoPs examined here are old (their ages are between 11 and 20 years as of April 2009).

4. Level of maturity is defined by Dubé et al. [17] as how mature individual CoPs are, and the scale of maturity level is based on Wenger et al.'s [8] stages of community development (potential, coalescing, maturing, stewardship, and transformation). As it will be explained next, we propose two stages "stability" and "disband," and elaborated on the development process ("disband" and "transformation" can occur following any of the other stages). Dubé et al. [17] suggested that a higher level of maturity could occur, but they did not elaborate on it in their typology. We recommend the addition of a 'stability' stage to the level of maturity category, because the three CoPs that we have observed expose characteristics of this stage. Unlike the stewardship stage, in which the online CoP attempts to sustain its momentum (further development), in the stability stage, online CoPs maintain the current status quo; membership may fluctuate a little but not in a major way; the leadership roles are stable. Although stability is a positive sign for the sustainability of CoPs, Roberts [38] cautioned that the knowledge shared in CoPs may

become inert if CoPs are too stabilized. The other stage that we suggest to add to the level of maturity dimension is the "disband" stage. Gongla and Rizzuto [39] also argue that CoPs are living entities that do not live forever. Therefore, an additional stage of 'disband' should be added as a possible stage, one that could occur after each of the other stages. Although Dubé et al. stated that one of the online CoPs they studied went through a 'disband' stage, it was not clearly specified as a stage in their definitions. The addition of a fifth stage here is similar to Tuckman and Jensen's [40] addition of a fifth stage, adjourning to Tuckman's [41] earlier model of team development that specified four stages: forming, storming, norming, and performing. Based on this model, groups differ in their task behavior and interpersonal relationships at different stages of development [41]. We also suggest that, similar to the disband stage that can occur after any of the other stages, the 'transformation' stage can occur after any of the other stages as well. In sum, the possible values for this category include: potential, coalescing, maturing, stewardship, transformation, stability, and disband.

Table 3
Revised demographic dimension

	DR-l	**ET-l**	**UW-l**
1. Orientation	Operational	Operational	Operational
2. Life span	Continuous	Continuous	Continuous
3. Age	Old (founded in 1997)	Old (founded in 1989)	Old (founded in 1997)
4. Level of maturity	Stability stage	Stability stage	Stability stage

4.3. Context

Among the four categories from Dubé et al.'s [17] typology, the second dimension, context, requires the most changes in order to adjust it to be inclusive of open online CoPs. In Dubé et al.'s [17] original typology, this dimension was called 'organizational

context' and consisted of six categories: creation process, boundary crossing, environment, organizational slack, degree of institutionalized formalism, and leadership. We changed the label for this dimension from 'organizational context' to 'context,' so that it will not be restricted to organizational settings but instead will be inclusive for the three open online CoPs. Also, because three of the categories under this dimension (environment, organizational slack, and degree of institutionalized formalism) are specific to organizational CoPs, we kept these categories but coded them as not applicable except for the values of organizational slack and degree of institutionalized formalism for ET-l. We modified the first two of the six categories put forth by Dubé at al. (creation process; boundary crossing) and elaborated on the last category (leadership). Moreover, we added two new categories (knowledge sharing culture, organizational sponsorship) to address the dimension of 'context.' In the end, this dimension includes eight categories (Table 4): creation process; boundary crossing; knowledge sharing culture; organizational sponsorship; environment; organizational slack; degree of institutionalized formalism; and leadership (moderator, active participants, founding members).

1. The first category in this dimension is about the creation process of online CoPs. Dubé et al. [17] suggest spontaneous and intentional values to describe individual CoP creation processes. We suggest that the values should be described as either grassroots (voluntarily) or top down (intentional) based on the use of George, Iacono, and Kling's [42] discussion of an implementation strategy for learning in context (i.e., communities of practice). This category is closely related to 'orientation' in the previous section in the sense that both describe the origins of CoPs. However, 'orientation' refers to the nature of

CoPs, whereas 'creation process' describes the process of cultivating CoPs. The creation of DR-l was top-down, and the creation of ET-l and UW-l was bottom-up.

2. The second category, boundary crossing, is about the extent to which online CoPs cross boundaries. Dubé et al. [17] suggest a range of values from low to high in regard to departmental and organizational boundaries. We considered two types of boundaries as sub-categories of boundary crossing: organizational and professional. We did not include national boundary crossing because, as Bell and Kozlowski [37] argue, when organizational boundary crossing is high so is cultural (national) boundary crossing. Because each of the three CoPs was formed around a specific profession, the disciplinary boundary crossing for all three is low; but at the same time, organizational boundary crossing is high for all three open online CoPs.

3. The third category, knowledge sharing culture, examines how the culture values knowledge sharing. We speculated that the culture surrounding specific professions would influence the attitudes and behaviours of knowledge sharing in professional online CoPs. In order to analyze the three online CoPs under this category, a content analysis approach was used to examine each profession's code of ethics as the formal representation of their values [43]. The code of ethics we examined are: Code of ethics from the American Library Association (ALA) for DR-l, the Association for Educational Communications and Technology (AECT)[1] code of ethics for ET-l, and the Association of Computing Machinery (ACM) code of ethics for UW-l. It was assumed that variations in the emphasis on information sharing in the code of ethics for a profession may be indicative of the relevant importance this value has in the specific professional culture.

[1] AECT's members consist of people who are K-12 educational technologists as well as faculty members and some educational consultants.

As Pan and Leidner [44] contend, guidelines such as those outlined in a code of ethics inform individuals how to participate in information sharing activities. Thus, we employed a descriptive approach [45] to examine the codes and found that all three codes emphasize information sharing. It should be noted that for CoPs that do not have stated values (CoPs that are cross-disciplinary), this category is not applicable.

4. The fourth category, organizational sponsorship, identifies whether any organization sponsors CoPs. For example, DR-l was initially sponsored by a non-profit organization, which no longer exists. During its first years, ET-1 was supported and hosted by a research university located in the Midwest region of the U.S. ET-1 was later moved to another research university, also located in the Midwest. Its staff worked with the discussion list for many years, until it found its current home with an interdisciplinary organization of scholars and educators. Therefore, we proposed that the possible value should be 'yes' or 'no,' and the assigned values are as follows: DR-l and ET-l were yes, and UW-l was no.

5. Environment was referred to as the degree to which the online CoPs' organizational context is supportive [17]. In the original framework, Dubé et al. [17] defined the degree for this category as facilitating, neutral, or obstructive to the development of the CoP. For an open CoP, this category is not relevant, and for that reason we kept this category as is.

6. Organizational slack was described as the resource surplus that an organization can use. When the slack is large, the organization can provide more resources to support a particular online CoP; the range of this category was from high to low [17]. We kept this category as is because, in the context of open CoPs, organizational slack is the same as

CoPs that operate within organizational settings, or it is not relevant when no organizational sponsorship exists for the open CoP. Two of our CoPs (DR-l and UW-l) have no organizational sponsorship (although DR-l had organizational sponsorship originally). Thus, the value of not applicable was assigned for DR-1 and UW-1. While one (ET-1) had support for years from an academic institution, the coordination and support for this list has moved to an international consortium that focuses on the use of communication technologies to facilitate knowledge exchange among discussion participants. ET-1 has become a member of this consortium, which supports and coordinates the list. This organization also provides a few networking services and member benefits to ET-1; therefore, the value of low was assigned for ET-1.

7. Degree of institutionalized formalism questions the extent to which an online CoP is formalized by the institution [17]. On the one hand, some organizational CoPs are informal and not recognized by the organization in which they exist. Plaskoff [46], for example, suggested that participation in CoPs should be separated from project teams to increase their effectiveness (although he did not refute institutionalization of CoPs). On the other hand, some organizational CoPs are truly integrated within the institutions' official structures. Thus, Dubé et al. [17] proposed the range to be from unrecognized to institutionalized. CoP institutionalization was not part of the early conception of CoPs; CoPs often exist without organizational reorganization; yet, some CoPs are used as a knowledge management tool in organizations (e.g., [8], [44]). The question whether successful CoPs would be fostered within formal organizational structures was often raised by researchers (e.g., [32]), and this question remains to be further examined. Thus, we kept this category as it is for open online CoPs. The category is particularly relevant

for open CoPs with organizational sponsorship. For the three online CoPs we examined, we assigned the values of not applicable for DR-l and UW-l (due to no organizational sponsorship), and the value of supported for ET-l

8. The last category, leadership, was expanded from one category in Dubé et al.'s [17] typology to three leadership sub-categories. One type of leader includes the core members who are more active in the online forum than others; these leaders may take the leadership role over long or short period of times by having high visibility. Their leadership role is a result of the amount, frequency and significant impact of their contributions. The second type of leader is the founding members who may not be as active online. These founding members are not typically identified, although they may take action when some crisis occurs, such as deciding on future directions and discussing the raison d'être for the CoP. The third type of leader in online CoPs involves moderators whose roles vary from filtering messages to handling and resolving conflict. We suggest using Dubé et al.'s [17] proposed range –clearly defined and continuously negotiated for the first two leadership sub-categories (active participants and founding members) –and propose adding a 'rotating' value for the third sub-category (moderator), which, according to Davis and Eisenhart [47], can impact the result of group interactions:

> While less successful collaborations are associated with domineering leadership or consensus leadership processes, successful collaborations use a rotating leadership process that creates transient unilateral leadership opportunities [47, p.2].

In terms of active participants, all three online CoPs are continuously negotiated. For example, depending on individual's expertise, different active participants may lead

discussions regarding specific topics. Or when conflicts occur, ad hoc leaders may rise to redirect discussions and attempt to mediate disputes. With regard to the founding members, all three are clearly defined. When considering leadership in terms of moderators, DR-l is clearly defined, ET-l is rotating, and UW-l is clearly defined.

Table 4
Revised context dimension

	DR-l	**ET-l**	**UW-l**
1. Creation process	Top-down	Bottom-up	Bottom-up
2. Boundary crossing a. profession b. organization	 Low High	 Low High	 Low High
3. Knowledge sharing culture	High	High	High
4.Organizational sponsorship	Yes	Yes	No
5. Environment	N.A.	N.A.	N.A.
6. Organizational slack	N.A.	Low	N.A.
7. Degree of institutionalized formalism	N.A.	Supported.	N.A.
8. Leadership a. active participants b. founding members c. moderator	 Continuously negotiated Clearly defined Clearly defined	 Continuously negotiated Clearly defined Rotating	 Continuously negotiated Clearly defined Clearly defined

4.4. Membership characteristics

For this dimension, membership characteristics, Dubé et al.'s [17] original categories were deemed appropriate for open online CoPs in general, because the composition of aspects that characterize membership does not depend on whether CoPs are open or organizational (Table 5). However, we elaborated on the 'cultural diversity' category.

1. The first category, size, refers to the size of online CoPs in regard to the number of members. Based on the definition put forth by Dubé et al. [33], membership figures under 100 are small and more than 100 are large. However, we refined this category by dividing it into three sections: a CoP with fewer than 100 members is small, between 100 and 1000 is medium, and more than 1000 is large. Roberts [38] argues that both size and geographical dispersion need to be taken into consideration when conceptualizing CoPs. Certainly, a co-located CoP that has a membership of 30 individuals has much tighter and more frequent interactions than a geographically dispersed online CoP that involves over 1000 members. It is worth noting that open CoPs are more likely to have larger numbers than intra-organizational CoPs. According to our definition, all three online CoPs are large in terms of their overall membership size.

2. The second category is geographic dispersion. Dubé et al. defined this category as "the physical location of the participants" [17, p. 78] and specified that its range was from low to high. This category is appropriate for open online CoPs as is. O'Leary and Cummings [48] expand on the concept of geographical dispersion in terms of spatial, temporal, and configurational dimensions. Obviously, the various countries of residency of CoP members also indicate geographical dispersion. Thus, all three online CoPs that we analyzed have high geographic dispersion. For instance, although the most active participants in ET-l are based in the U.S., this CoP has members representing about 50 countries. Similarly, most of the participants in DR-l and UW-l are from the U.S., but they are not co-located.

3. Member selection is defined as how CoP members are selected. It varies from closed to open according to Dubé et al. [17]. Open member selection refers to CoPs that

anyone who is interested can join. All three open online CoPs have open member selection processes.

4. The fourth is member enrolment. Dubé et al. [17] defined this as how members decide whether to enrol in an online CoP. They also suggest that the range is from voluntary to compulsory. All three online CoPs have a voluntary enrolment process. In fact, this is an important factor for sustainable online CoPs; membership self-selection to join the online CoP was determined to be one of the six factors for CoP sustainability [49].

5. The fifth category is the member's prior community experience, which refers to whether members have a shared history as members of the same group in the past. Dubé et al. [17] defined the range as spanning from extensive to none. Schein argues: "For shared learning to occur, there must be a history of shared experience, which in turn implies some stability of membership in the group" [50, p. 10]. For the three open online CoPs that were examined, members are from many different organizations that are a distance apart; thus, prior experience is assumed to be low compared to CoPs within an organization whose members are collocated.

6. The sixth category is membership stability. Dubé et al. [17] defined online CoPs as having permanent membership or changing membership and characterized this category as ranging from stable to fluid. The stability of the membership relates to viability of an online community. Within the context of virtual teams, Sundstrom, DeMuese, and Futrell [51] suggested that team viability is an indicator for team effectiveness. In order for online CoPs to be viable and for a culture to be reflected in the discussion, some of the membership needs to be stable [50]. Therefore, we identified how many of active

members change by examining the names of members who post messages in October of 2004, 2005, and 2006. For DR-l, 18.5% of members who posted messages in October 2004 and 2005 and 8.6% of active members in October 2005 and 2006 remained the same. Only 3.7% of the active members appear in October 2004, 2005, and 2006. For UW-l, 48.7% of the same members in October 2004 and 2005 and 29.6% of the same members in October 2005 and 2006 posted messages. 21.7% of the active members stayed in October, 2004, 2005, and 2006. In October 2004 and 2005, 27.7% of the active ET-1 members remained the same. The percentage of members who posted messages in October 2005 and 2006 decreased to 23.7%. For October 2004, 2005, and 2006, 12.9% of the same members were actively involved in the list discussions. We assigned a value, high, for this category when the active members remain above 80% on average, low when the same members appear below 20% on average, and medium for between 20% and 80%. Hence, the assigned values are low, medium, and medium for DR-l, ET-l, and UW-l respectively.

7. The seventh is members' ICT literacy. Dubé et al. [17] defined this category as the number of members of online CoPs who are comfortable with ICTs and specified that it ranges from high to low. Studies show that people's perceptions about ICTs will influence whether people actually use the technologies (e.g., [52], [53], [54]). Because all three of the online CoPs examined involve members that work with technologies in their respective organizations, we estimated that the values for our three online CoPs are high.

8. The eighth category is cultural diversity. Dubé et al. stated that three levels of cultural influence must be considered: national, organizational, and professional [17, p.80], but they assign only one aggregated value for this category. We propose that it

would be useful to create these three sub-categories under 'cultural diversity' and analyze them separately, because each type of diversity may contribute differently to the culture and operation of online CoPs. National cultural diversity, for example, was examined for each of the three CoPs. In DR-l, Americans generated 48 out of 50 messages; a British member and a New Zealander posted one message each. Among the 50 messages analyzed, UW-l's members came from two different countries; while they were predominantly from the U.S., some were from Canada. ET-l keeps statistics on members' nationalities. The majority of the ET-l's members are from the U.S. with a little more than 4,500 out of approximately 5,000 subscribers representing that country. In the sample from ET-1, specifically, 40 of the 50 messages were submitted by Americans. Members who resided outside the U.S. were from Canada, as well as various countries including Great Britain, India, Australia, Israel, Malaysia, Mexico, New Zealand, Spain, Taiwan, and the United Arab Emirates. In a few cases, however, the nationality was unknown. Overall, most of the participants on all three e-mail lists were from the U.S. with a few representing other countries. Therefore, we concluded that in terms of (national) cultural diversity, DR-l and UW-l are homogenous, and the majority of the members come from North America. Conversely, ET-l is more heterogeneous, because the members represent approximately 50 different countries. Similarly, DR-l and UW-l are homogenous in terms of professional and organizational diversity, whereas ET-l is heterogeneous. We reached this conclusion because DR-l members primarily consist of reference librarians who are interested in digital reference services, and UW-l members primarily consist of webmasters who work for higher education institutions. In contrast, many ET-l members are educational technologists who work for K-12 institutions,

although there are also faculty members who teach educational technologies as well as consultants who advise educational technologists. For example, of the 50 ET-l messages in the study sample, 22 were posted by members who worked for K-12 institutions, whereas 16 were posted by those in academia.

9. The final category for this dimension refers to the relevancy of the CoP discussion topics to its members. For this category, Dubé at al. outline a range from high to low: topics that are relevant to most members' daily work [33, p.151] are high, and those that have no topic relevance are low. In order to operationalize the category, we did a content analysis of 50 messages for each CoP. We identified topic relevancy by imagining that we were one of the participants subscribing to the lists and determining whether each message was relevant to the purpose/goal of the list. We particularly paid attention to the reason why members are subscribed to this specific e-mail list. The values we assigned to the category are high, medium, and low. When more than 80% of the messages were relevant, we assigned the value high; 50% or less was coded as low, and medium was between 80% and 50%. The number of relevant messages for each of the three CoPs, DR-l, ET-l, and UW-l, were 47, 44, and 47 out of 50 respectively. In other words, the values for all three CoPs, which were greater than 80%, are high.

We further analyzed the types of messages posted online for each of the three online CoPs (Appendix A). For all three, sharing knowledge (48%, 68%, 54%; DR-l, ET-l & UW-l respectively) and solicitation (20%, 26%, 28%; DR-l, ET-l & UW-l respectively) are the dominant categories. For DR-l only, announcement (22%) is a common message type. We speculate that the reason DR-l has more announcement messages than the other two is that librarians tend to share information as part of their daily work practice.

Overall these findings represent the similarity of three cultures of CoPs and provide a foundation for the currently existing CoPs and the future extension of them. The fact that the primary activities in these CoPs are knowledge sharing and solicitation indicates that the members are engaging in information exchange and learning activities through these online discussion forums [27]. Also, this analysis further confirmed that the three online forums possess characteristics of CoPs.

Table 5
Revised membership characteristics dimension

	DR-l	**ET-l**	**UW-l**
1. Size	Large	Large	Large (> 1000)
2. Geographic dispersion	High	High	High
3. Members' selection process	Open	Open	Open
4. Members' enrolment	Voluntary	Voluntary	Voluntary
5. Members' prior community experience	Low	Low	Low
6. Membership stability	Low	Medium	Medium
7. Members' ICT literacy	High (estimate)	High (estimate)	High (estimate)
8. Cultural diversity— a. national b. organizational c. professional	Homogenous Homogeneous (mostly academic lib) Homogenous	Heterogeneous Heterogeneous (K-12, higher education, consulting) Heterogeneous	Homogeneous Homogeneous (mostly college) Homogenous
8. Topics' relevancy to Members	High	High	High

4.5. Technological environment

The dimension of technological environment remains to be the same as Dubé et al.'s [17] typology except for the value in the first category, degree of reliance on ICT. The other category included here is ICT variety.

1. Degree of reliance on ICT is defined by Dubé et al. [17] as the degree to which CoPs use ICTs, ranging from high to low. In addition, solely reliant on ICT was added to include the case of no face-to-face opportunities. CoPs vary on their electronic dependence, which refers to the relative extent of electronic versus face-to-face communication [55]. Because the three online CoPs that we examined exist only in online environments, we considered all three to be solely reliant on ICTs.

2. ICT variety was called ICT availability by Dubé et al. [17]. They defined low variety as one piece of software and high variety as a wide variety of ICTs. A number of commercial software products are available to support online CoPs (e.g., WebBoards and Wikis). We proposed a label change, because this category identifies the availability of diverse types of ICTs for each CoP. DR-l has high ICT variety because it uses both Yahoo! Groups and e-mail list technologies. ET-l is also considered high because it offers access to the discussion through Google Groups, AskEric, private bulletin boards at several universities, and the e-mail list. Finally, UW-l uses an e-mail interface and does not appear to use additional ICTs. Therefore, UW-1 has low ICT variety.

Table 6
Revised technological environment dimension

	DR-l	**ET-l**	**UW-l**
1. Degree of reliance on ICT	Sole	Sole	Sole
2. ICT variety	High	High	Low

5. Conclusions

This paper extends Dubé et al. [17] typology of CoPs to account for CoPs that exists within organizational setting and those are not constrained by organizational context. This paper provides an account of the cumulative knowledge on online CoPs. As the Web 2.0 becomes an available vehicle for knowledge sharing online, a framework that includes open online CoPs is beneficial. This study addresses this lacuna and provides a typology that was developed based on the existing cumulative knowledge about online CoPs and was supported with an analysis of three open online CoPs.

This study attempted to improve Dubé et al.'s [17] typology by extending and modifying it. Dubé et al.'s [17] efforts was one of the first few to synthesize case studies into a systematic typology and has its merit. At the same time, the original typology developed by Dubé et al. [17] is limited because it is based solely on online CoPs that exist within an organizational setting. Our analysis revealed that although many of the dimensions in Dubé et al.'s typology were generally applicable to open online CoPs, some fine-tuning was necessary. In particular, the 'context' dimension and many of the categories within it were revised or expanded. By using the proposed typology, the analysis of online CoPs can address both types of online CoPs: CoPs within an organizational setting and open CoPs.

It is important to note that one limitation of the study is the small sample size (three open online CoPs) and the lack of inclusion of online CoPs within organizations. Future studies could expand the number of CoPs to test the robustness of the proposed framework. It also would be useful, for fine-tuning the dimensions, to use a sample that contains both CoPs within an organizational setting and open CoPs. Finally, the

categorization of CoPs was based on available data that primarily rely on archival data of the messages posted on the online forums.

By developing an anatomy of online CoPs, various aspects of online CoPs can be analyzed. The typology also informs practitioners about how to utilize dimensions that support implementation of effective online CoPs for specific purposes. For example, if the size of membership is increasing, it is likely that people are participating in the discussions and helping other members even when they are receiving no immediate benefits from their contributions [29]. If, on the other hand, membership size is decreasing, it would be useful to examine the degree of topic relevance. In addition, one of the reasons why people do not participate in knowledge sharing online is due to technology [15]. By looking at ICT variety and the target population, the difference in levels of member participation may be better understood. Future systematic research with more extensive examination of online CoPs is sought.

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Appendix A

In order to understand the information sharing activities that occur in three e-mail lists, a content analysis was employed. This serves two purposes: to confirm that the forums are CoPs and to identify the messages' topic relevancy to members of the CoPs. As part of the process to achieve the first goal, we examined whether the selected lists possess characteristics of online CoPs by determining if knowledge sharing is one of the primary types of messages of exchange. If one-way interactions happen more frequently than knowledge sharing, the lists would not be considered CoPs. Then, as part of the process of mapping the lists under each of the categories we examined: 1) relevancy of messages topic to members (the ninth category of the membership dimension); 2) boundary crossing category; and 3) cultural diversity.

Data collection and analysis

Fifty representative messages posted during October 2005 were selected from ET-l, UW-l, and DR-l; these 150 messages were analyzed to examine boundary crossing, cultural diversity and topic relevance categories, and the content.

We used a coding scheme based on Hara and Hew's [16] categories to examine the types of activities apparent in the messages that are vigorous in a particular online CoP. The Hara and Hew coding scheme had six categories: solicitation, appreciation, administrative, announcement, clarification, sharing knowledge. We expanded on their work and identified three additional categories of messages: misdirected messages, unreadable messages, and humor. The final coding scheme is composed of nine categories and is described in Table 7.

The coding scheme was modified iteratively using different sets of online postings until we reached a consensus. To assure coding reliability, 20% of the messages were coded by 2 coders, and these were used to calculate the inter-coder reliability. Intercoder reliability (number of agreement divided by the number of agreements plus the number of disagreement) was 93%.

Table 7
Coding scheme

1. Solication	request for help or ideas.
2. Appreciation	present the feeling of gratitude, for example, by saying thank you.
3. Administrative	provide administrative support for the e-mail lists.
4. Announcement	post an announcement of job openings or conference notice.
5. Clarification	offer additional information when further questions raised after someone responds to the original question.
6. Knowledge sharing	share any types of knowledge in response to solicitation.
7. Misdirected message	being posted to the entire list when the message was meant to be sent to a particular individual.
8. Unreadable message	being encoded wrongly, so that messages are not readable due to mechanical problems.
9. Humor	share humorous comments or forward jokes.

Findings

Figure 1 and Table 8 present the results of the content analysis that we conducted in order to identify types of messages exchanged in the three CoPs.

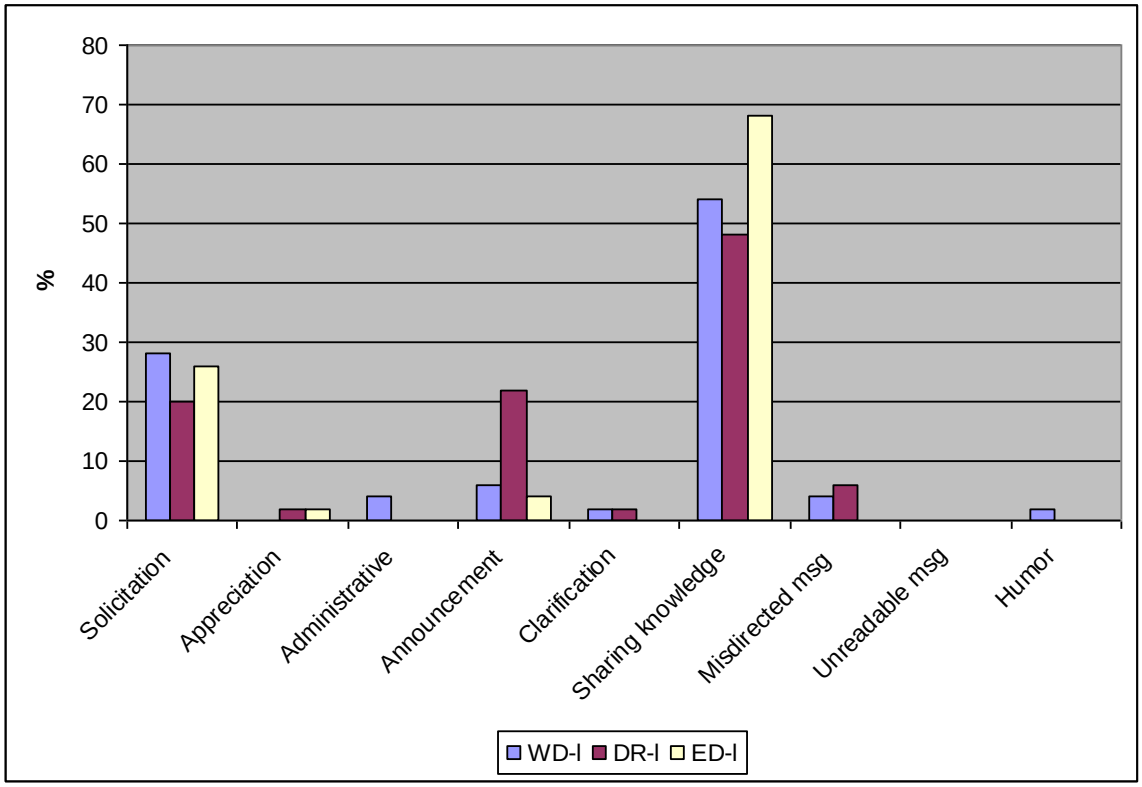

Figure 1. Types of messages.

Table 8
Type of messages posted on the three lists

Category	Frequency		
	UW-l	DR-l	ET-l
Solicitation	14	10	13
Appreciation	0	1	1
Administrative	2	0	0
Announcement	3	11	2
Clarification	1	1	0
Sharing knowledge	27	24	34
Misdirected msg	2	3	0
Unreadable msg	0	0	0
Humor	1	0	0
Total	50	50	50

Because ET-l assigned a moderator who checked and filtered all the incoming messages, there were no misdirected messages and no unreadable messages. In contrast,

while DR-l and UW-l had moderators, they did not seem to filter messages[2], as we found misdirected messages.

The remaining categories - appreciation, administrative, clarification, humor - are not prominent activities (Figure 1). In fact, only a small portion of our sample included such messages. We speculated that this was because these types of messages have marginal function to the CoPs.

The analysis of the types of messages not only provides information regarding the topic relevance to members but also sheds light on the anatomy of discussions occurring in online CoPs.

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